IYGB GCE

Mathematics MP2

Advanced Level

Practice Paper G

Difficulty Rating: 3.6850/1.2095

Time: 2 hours

Candidates may use any calculator allowed by the regulations of this examination.

Information for Candidates

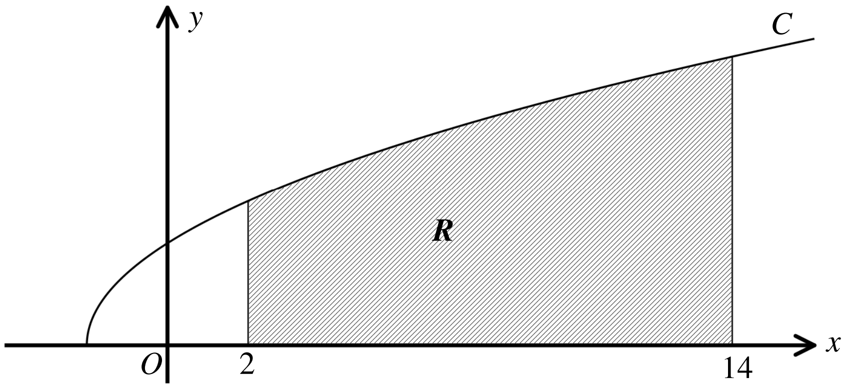
This practice paper follows closely the Pearson Edexcel Syllabus, suitable for first assessment Summer 2018.

The standard booklet "Mathematical Formulae and Statistical Tables" may be used.
Full marks may be obtained for answers to ALL questions.
The marks for the parts of questions are shown in round brackets, e.g. **(2)**.
There are 12 questions in this question paper.
The total mark for this paper is 100.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You must show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.
Non exact answers should be given to an appropriate degree of accuracy.
The examiner may refuse to mark any parts of questions if deemed not to be legible.

Question 1



The figure above shows the curve C, given parametrically by

$$x = t^2 - 2, \quad y = 6t \ , \ t \geq 0 .$$

The finite region R is bounded by C, the x axis and the straight lines with equations $x = 2$ and $x = 14$.

a) Show that the area of R is given by

$$\int_2^T 12t^2 \ dt \ ,$$

stating the value of T. **(5)**

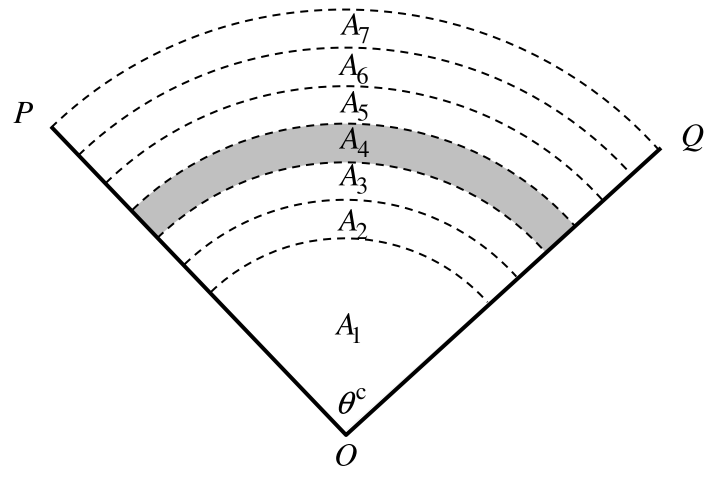
b) Hence find the area of R. **(2)**

Question 2

Prove by the method of **contradiction** that there are no integers n and m which satisfy the following equation.

$$3n + 21m = 137$$ **(4)**

Question 3



The figure above shows a grid used to help spectators estimate the throwing distances of athletes in a shot put competition. The grid consists of circular sectors each with centre at O and the angle POQ is θ radians.

The radius of the smaller sector is 10 metres and each of the other sectors has a radius 2 metres more than the previous one.

The perimeter of A_4, shown shaded in the figure, is 1.4 times larger than the perimeter of the **sector** A_1.

Determine the value of θ.

Question 4

$$f(x) = \frac{1}{\sqrt{1+4x}}, \quad -\tfrac{1}{4} < x < \tfrac{1}{4}.$$

a) Find the binomial series expansion of $f(x)$ up and including the term in x^3.
(4)

b) Hence determine the coefficient of x^3 in the binomial expansion of $f\left(x+x^2\right)$.
(4)

Question 5

A curve C has equation

$$y = (x+1)^2 e^{2x}, \ x \in \mathbb{R}.$$

a) Show that

i. $\dfrac{dy}{dx} = 2(x+1)(x+2)e^{2x}$. **(5)**

ii. $\dfrac{d^2y}{dx^2} = 2\left(2x^2+8x+7\right)e^{2x}$. **(4)**

b) Hence, or otherwise, find the exact coordinates of the stationary points of C and determine their nature. **(6)**

Question 6

A curve C is defined parametrically by

$$x = t + \ln t, \quad y = t - \ln t, \quad t > 0.$$

a) Find the coordinates of the turning point of C . **(5)**

b) Show that a Cartesian equation for C is

$$4e^{x-y} = (x+y)^2.$$ **(5)**

Question 7

The variable points $A(1,8,t-1)$ and $B(2t-1,4,3t-1)$, where t is a scalar variable, are referred relative to a fixed origin O.

Find the shortest distance between A and B, as t varies. **(7)**

Question 8

Water is pouring into a container at a constant rate of 0.05 m^3 per hour and is leaking from a hole at the base of the container at the rate of $\frac{4V}{5} \text{ m}^3$ per hour, where $V \text{ m}^3$ is the volume of the water in the container.

a) Show clearly that

$$-20\frac{dV}{dt} = 16V - 1,$$

where t is the time measured in hours. **(3)**

Initially there were 4 m^3 of water in the container.

b) Show further that

$$V = \frac{1}{16}\left(1 + 63\mathrm{e}^{-\frac{4}{5}t}\right).$$ **(8)**

c) State, with justification, the minimum volume that the water in the container will ever attain. **(1)**

Question 9

Oil leaking from a damaged tanker is forming a circular oil spillage on the surface of the sea, whose area is increasing at the constant rate of $360 \text{ m}^2 \text{ s}^{-1}$.

We may assume that the spillage is of negligible thickness.

a) Find the rate at which the radius of the oil spillage is increasing when the radius of the spillage reaches 100 m. **(4)**

b) Determine the rate at which the radius of the oil spillage is increasing 1 minute after it started forming. **(4)**

Question 10

Given that

$$64\cos 2\theta \cos\theta + 32\sin 2\theta \sin\theta = 27 ,$$

find the value of $\cos\theta$. **(6)**

Question 11

Find the value of x that satisfies the equation

$$\sum_{r=1}^{20} (2r + x) = 280 .$$ **(6)**

Question 12

$$f(x) \equiv 2 - \sqrt{x-1} , \ x \geq 1 .$$

a) Find a simplified expression for $g(x)$ so that $f(x)g(x) = 1$. **(4)**

b) Hence, or otherwise, find

$$\int \frac{5-x}{2-\sqrt{x-1}} \, dx .$$ **(6)**
